BRITISH GEOLOGICAL SURVEY

DETR

CORNWALL

A Summary of Mineral Resource Information for Development Plans: Phase One

Mineral Resources

Scale 1:100 000

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Positions of Scheduled Monuments at 31st March 1994 as supplied by English Heritage. The majority of monuments are plotted using a centred NGR symbol. Consequently the actual area and/or length of a monument protected by the legal constraints of scheduling cannot be represented here. Monuments scheduled or descheduled since that date are not accounted for.

AIMS AND LIMITATIONS

The purpose of the maps and associated reports in this series is to show the broad distribution of those mineral resources which may be of current or potential economic interest and to relate these to selected nationally-recognised planning constraints.The maps are intended to assist in the consideration and preparation of development plan policies in respect of mineral extraction and the protection of important mineral resources. They bring together a wide range of information, much of which is scattered and not always available in a convenient form.

The maps have been produced by collation and interpretation of mineral resource data principally held by the British Geological Survey. Information on mineral planning permissions has been obtained from the relevant Mineral Planning Authority. Some of these permissions may have lapsed or expired. The status of individual areas can be ascertained from the appropriate MPA. Location information on national planning designations has been obtained from the appropriate statutory body (Countryside Commission, English Nature and English Heritage). For further information, the appropriate body should be contacted.

The mineral resource data presented are based on the best available information, but are not comprehensive and their quality is variable. The inferred boundaries shown are, therefore, approximate. Extensive areas are excluded as having no mineral resource potential, but some isolated mineral workings may occur in these areas. The presence of these operations generally reflect very local or specific situations which are referred to in the accompanying report.

The maps are intended for general consideration of mineral issues in relation to other planning constraints, and not as a source of detailed information on specific sites. The maps should not be used to determine individual planning applications or in taking other decisions on acquisition or use of a particular piece of land, although they may give useful background information which sets a specific proposal within context.

CHINA CLAY (Kaolin)
- Measured and indicated resources
- Inferred resources
- Micaceous residue dams containing variable amounts and qualities of recoverable china clay

IGNEOUS AND METAMORPHIC ROCKS
- Granite

BASIC IGNEOUS ROCKS
- Intrusive (dolerite, gabbro) and extrusive (basalt, spilite and volcanic ash)

ULTRABASIC IGNEOUS ROCKS
- Serpentinite / Picrite

METAMORPHIC ROCKS
- Metamorphic (undifferentiated)

SANDSTONE
- Interbedded sandstone and shale / slate

SAND
- Silica sand and clay
- Blown sand

SLATE
- Slate resources

MINERAL WORKINGS
- ● Surface mineral working
- ▲ Underground mineral working

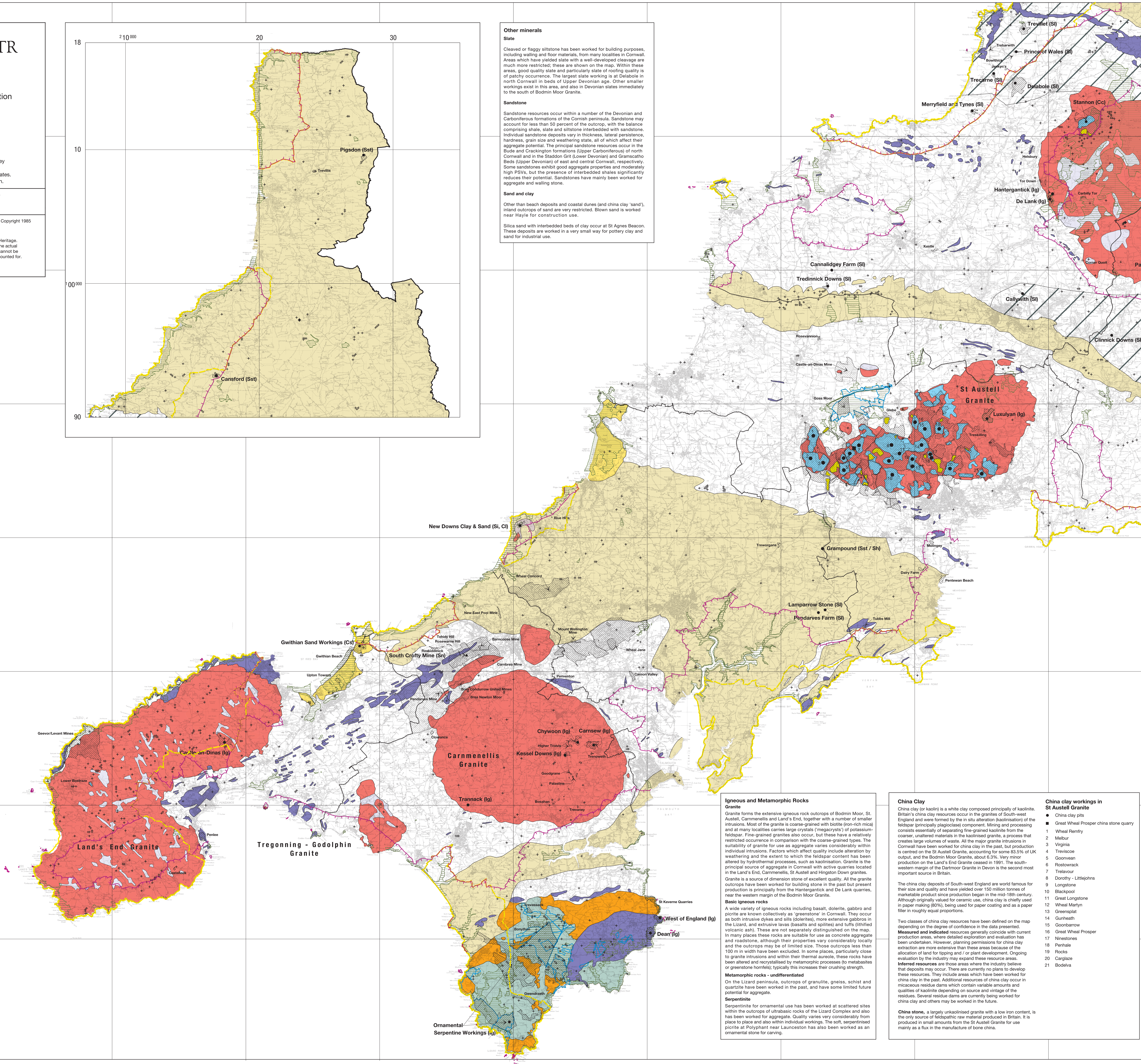
Mineral Commodity

Cc	China clay	Cs	Construction sand
Ig	Igneous rock	Sn	Tin
Sst / Sh	Sandstone / Shale	Sl	Slate
Si	Silica sand	Cl	Clay

MINERAL PLANNING PERMISSIONS (as at 1.10.1996)
Source: Cornwall County Council
- Surface permission
- Underground permission

ENVIRONMENTAL DESIGNATIONS
- Area of Outstanding Natural Beauty
- Heritage Coast
- Heritage Coast (Inland boundary)
- Site of Special Scientific Interest
- National Nature Reserve
- + Scheduled Monuments

ADMINISTRATIVE AREAS
- County
- District



Other minerals

Slate

Cleaved or flaggy siltstone has been worked for building purposes, including walling and floor materials, from many localities in Cornwall. Areas which have yielded slate with a well-developed cleavage are much more restricted; these are shown on the map. Within these areas, good quality slate and particularly slate of roofing quality is of patchy occurrence. The largest slate working is at Delabole in north Cornwall in beds of Upper Devonian age. Other smaller workings exist in this area, and also in Devonian slates immediately to the south of Bodmin Moor Granite.

Sandstone

Sandstone resources occur within a number of the Devonian and Carboniferous formations of the Cornish peninsula. Sandstone may account for less than 50 percent of the outcrop, with the balance comprising shale, slate and siltstone interbedded with sandstone. Individual sandstone deposits vary in thickness, lateral persistence, hardness, grain size and weathering state, all of which affect their aggregate potential. The principal sandstone resources occur in the Bude and Crackington formations (Upper Carboniferous) of north Cornwall and in the Staddon Grit (Lower Devonian) and Gramscatho Beds (Upper Devonian) of east and central Cornwall, respectively. Some sandstones exhibit good aggregate properties and moderately high PSVs, but the presence of interbedded shales significantly reduces their potential. Sandstones have mainly been worked for aggregate and walling stone.

Sand and clay

Other than beach deposits and coastal dunes (and china clay 'sand'), inland outcrops of sand are very restricted. Blown sand is worked near Hayle for construction use.

Silica sand with interbedded beds of clay occur at St Agnes Beacon. These deposits are worked in a very small way for pottery clay and sand for industrial use.

Igneous and Metamorphic Rocks

Granite

Granite forms the extensive igneous rock outcrops of Bodmin Moor, St. Austell, Carnmenellis and Land's End, together with a number of smaller intrusions. Most of the granite is coarse-grained with biotite (iron-rich mica) and at many localities carries large crystals ('megacrysts') of potassium-feldspar. Fine-grained granites also occur, but these have a relatively restricted occurrence in comparison with the coarse-grained types. The suitability of granite for use as aggregate varies considerably within individual intrusions. Factors which affect quality include alteration by weathering and the extent to which the feldspar content has been altered by hydrothermal processes, such as kaolinisation. Granite is the principal source of aggregate in Cornwall with active quarries located in the Land's End, Carnmenellis, St Austell and Hingston Down granites.

Granite is a source of dimension stone of excellent quality. All the granite outcrops have been worked for building stone in the past but present production is principally from the Hantergantick and De Lank quarries, near the western margin of the Bodmin Moor Granite.

Basic igneous rocks

A wide variety of igneous rocks including basalt, dolerite, gabbro and picrite are known collectively as 'greenstone' in Cornwall. They occur as both intrusive dykes and sills (dolerites), more extensive gabbros in the Lizard, and extrusive lavas (basalts and spilites) and tuffs (lithified volcanic ash). These are not separately distinguished on the map. In many places these rocks are suitable for use as concrete aggregate and roadstone, although their properties vary considerably locally and the outcrops may be of limited size. Those outcrops less than 100 m in width have been excluded. In some places, particularly close to granite intrusions and within their thermal aureole, these rocks have been altered and recrystallised by metamorphic processes (to metabasites or greenstone hornfels); typically this increases their crushing strength.

Metamorphic rocks - undifferentiated

On the Lizard peninsula, outcrops of granulite, gneiss, schist and quartzite have been worked in the past, and have some limited future potential for aggregate.

Serpentinite

Serpentinite for ornamental use has been worked at scattered sites within the outcrops of ultrabasic rocks of the Lizard Complex and also has been worked for aggregate. Quality varies very considerably from place to place and also within individual workings. The soft, serpentinised picrite at Polyphant near Launceston has also been worked as an ornamental stone for carving.

China Clay

China clay (or kaolin) is a white clay composed principally of kaolinite. Britain's china clay resources occur in the granites of South-west England and were formed by the in situ alteration (kaolinisation) of the feldspar (principally plagioclase) component. Mining and processing consists essentially of separating fine-grained kaolinite from the coarser, unaltered materials in the kaolinised granite, a process that creates large volumes of waste. All the major granite intrusions in Cornwall have been worked for china clay in the past, but production is centred on the St Austell Granite, accounting for some 83.5% of UK output, and the Bodmin Moor Granite, about 6.3%. Very minor production on the Land's End Granite ceased in 1991. The south-western margin of the Dartmoor Granite in Devon is the second most important source in Britain.

The china clay deposits of South-west England are world famous for their size and quality and have yielded over 150 million tonnes of marketable product since production began in the mid-18th century. Although originally valued for ceramic use, china clay is chiefly used in paper making (80%), being used for paper coating and as a paper filler in roughly equal proportions.

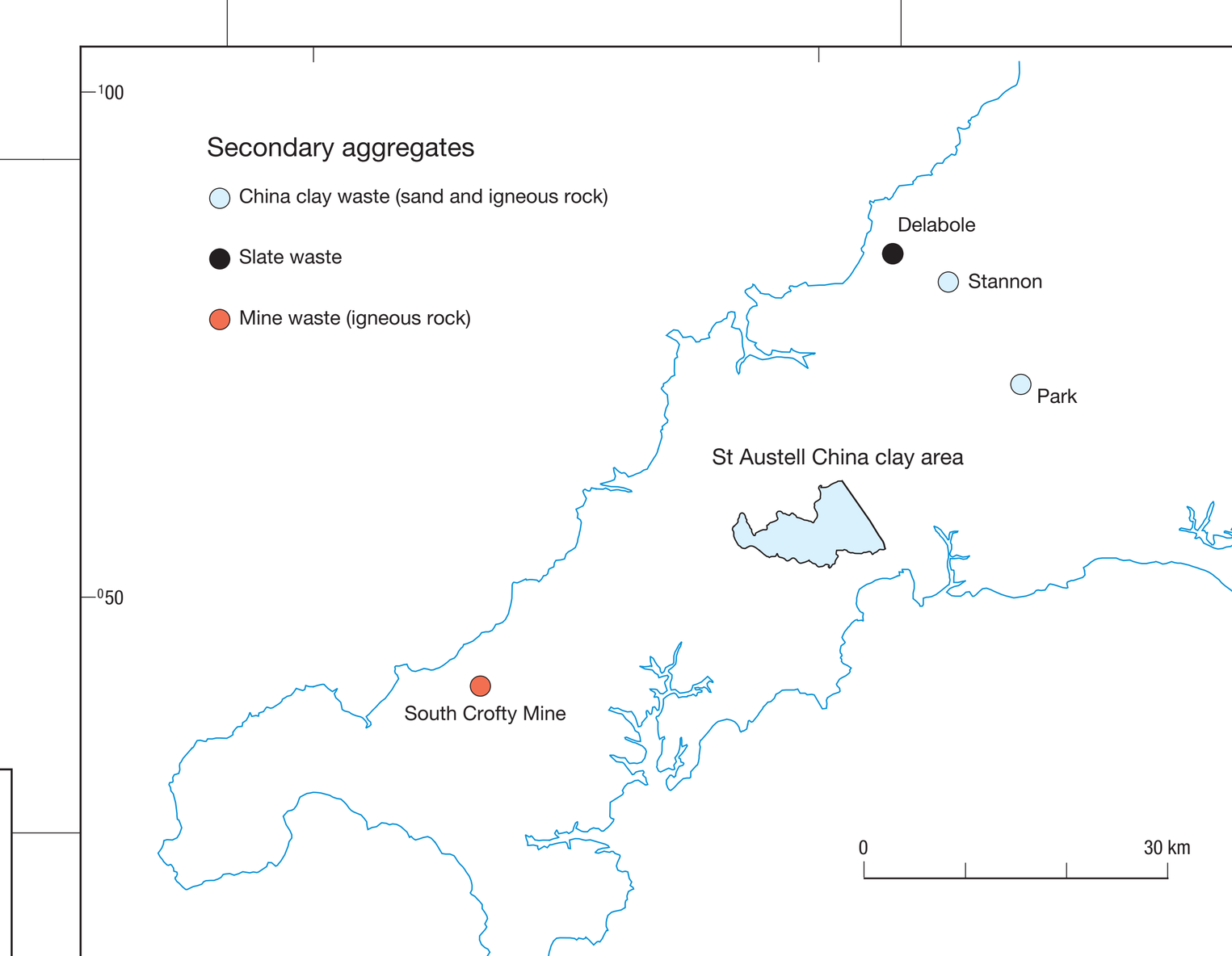
Two classes of china clay resources have been defined on the map depending on the degree of confidence in the data presented. **Measured and indicated** resources generally coincide with current production areas, where detailed exploration and evaluation has been undertaken. However, planning permissions for china clay extraction are more extensive than these areas because of the allocation of land for tipping and / or plant development. Ongoing evaluation by the industry may expand these resource areas. **Inferred resources** are those areas where the industry believe that deposits may occur. There are currently no plans to develop these resources. They include areas which have been worked for china clay in the past. Additional resources of china clay occur in micaceous residue dams which contain variable amounts and qualities of kaolinite depending on source and vintage of the residues. Several residue dams are currently being worked for china clay and others may be worked in the future.

China stone, a largely unkaolinised granite with a low iron content, is the only source of feldspathic raw material produced in Britain. It is produced in small amounts from the St Austell Granite for use mainly as a flux in the manufacture of bone china.

China clay workings in St Austell Granite

- ● China clay pits
- ■ Great Wheal Prosper china stone quarry

1 Wheal Remfry
2 Melbur
3 Virginia
4 Treviscoe
5 Goonvean
6 Rostowrack
7 Trelavour
8 Dorothy - Littlejohns
9 Longstone
10 Blackpool
11 Great Longstone
12 Wheal Martyn
13 Greensplat
14 Gunheath
15 Goonbarrow
16 Great Wheal Prosper
17 Ninestones
18 Penhale
19 Rocks
20 Carglaze
21 Bodelva

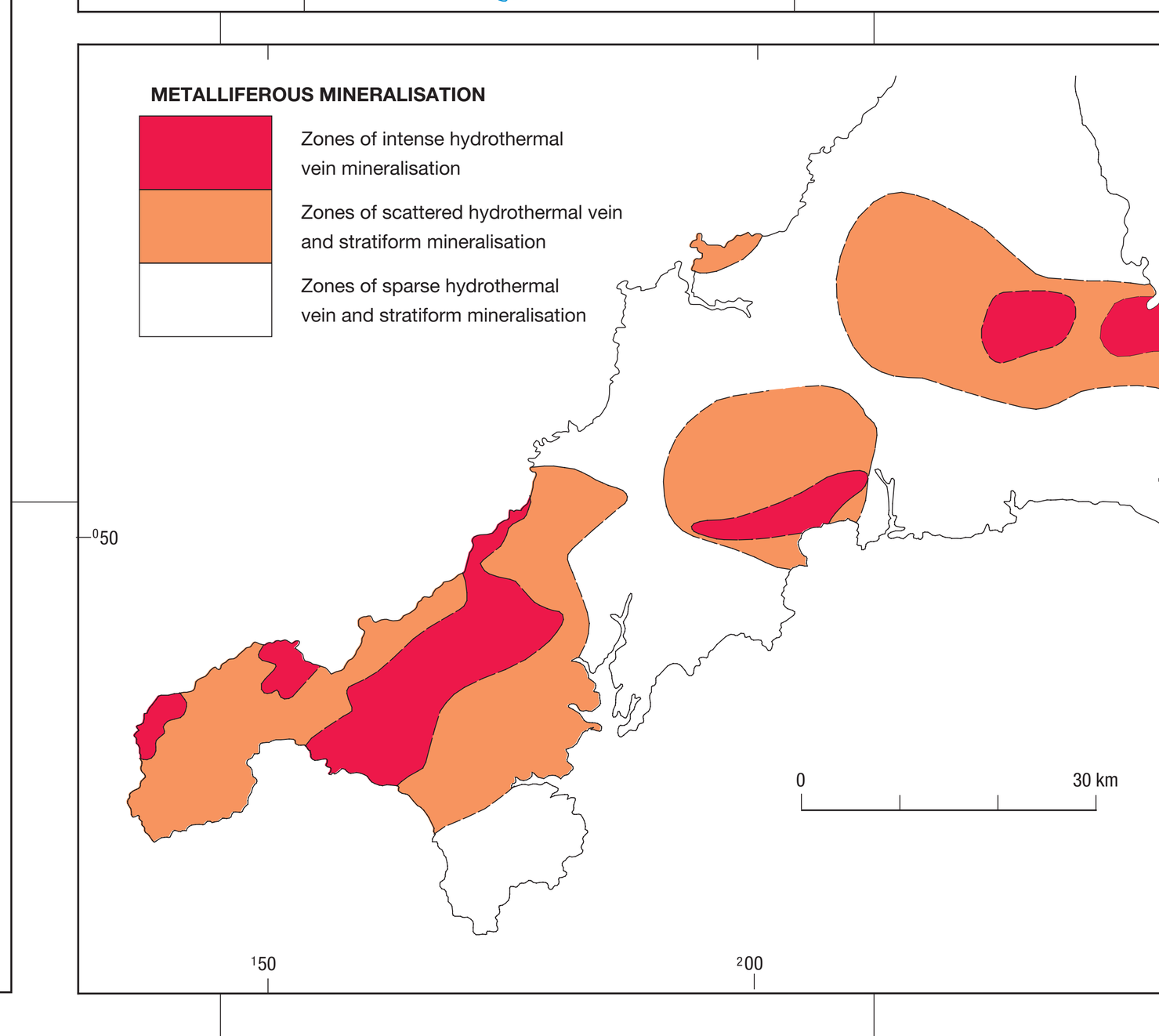


Secondary aggregates

Cornwall has very large resources of secondary aggregates. By far the most important is china clay waste (sand and rock) most of which occurs in the St Austell area where tips amount to some 430 million tonnes, although large tonnages have now been subject to restoration schemes. Arisings amount to some 25 million tonnes a year of which only 1.5 million tonnes is used. China clay waste is also associated with operations on Bodmin Moor.

Some 10 million tonnes of mixed slate waste and overburden are associated with the Delabole slate quarry. This material is however, sterilised by the surface processing facilities and restoration conditions. Waste generated during quarrying (some 50,000 t/y) is tipped within the quarry and all material brought to the surface is now sold in some form.

Spoil heaps resulting from the long history of non-ferrous metal mining in Cornwall are widely distributed. They are largely unsuitable for use as secondary aggregate because of a variable composition and presence of sulphides, and pose a potential pollution risk if disturbed. At South Crofty mine small amounts of granite produced during mine development are sold as aggregate.



Metalliferous mineralisation

Most of Cornwall's metalliferous deposits occur as veins with a close spatial relationship to the granite outcrops or to unexposed granite bodies at shallow depths below the present ground surface. Tin- and tungsten-bearing veins mostly occur within or close to the granites, while copper and arsenic veins extend into the surrounding country rocks. Deposits of lead and zinc are generally more distant. Certain horizons within the slate, sandstone and basic igneous rocks throughout Cornwall are enriched in heavy metals and contain mineralised structures, including veins and stratiform deposits that are unrelated to the granites and their thermal influence.

Tin and copper were the most important metal ores. Tin was initially worked from stream gravels ('placers'), with underground mining of veins taking over in the 16th Century. Tin production peaked at some 10,000 tonnes tin-in-concentrate in 1870-71,but declined thereafter. A resurgence in Cornish tin production,following the commissioning of Wheal Jane in 1971, increased output to 5200 tonnes tin-in-concentrate in 1984 and 1985. This level of output proved unsustainable in the face of low tin prices resulting in the closure of all the tin mines except South Crofty.

Copper was extensively worked from veins in the 18th and 19th centuries, but was abandoned as large-scale openpit deposits were discovered overseas. Arsenic was originally an undesirable companion of the tin and copper ores but was recovered in the late 19th century as a component of insecticides. Lead was produced from the medeival period onwards, especially ores with a higher silver content. Iron ores have been produced from a number of deposits including pyrite, which was mostly used in the manufacture of sulphuric acid. Other ores with a minor production included those of manganese, uranium, bismuth, cobalt and antimony.